

## Letter to the Editor

**Rectal probe temperature lag during rapid saline induction of hypothermia after resuscitation from cardiac arrest**

Sir,

As more hospitals use therapeutic hypothermia after cardiac arrest, and as techniques for rapid induction become more widely utilized, subtle but important points of cooling technique are emerging. During the induction phase of hypothermia the patient's core temperature can shift as rapidly as  $4^{\circ}\text{C}/\text{h}$ .<sup>1–3</sup> If the temperature monitoring system cannot keep pace by displaying the actual core body temperature, the patient may receive inappropriate treatment.

Recently, a patient was brought to our emergency department with return of spontaneous circulation after arrest. We placed an oesophageal temperature probe to a depth that would leave its tip behind the heart. The patient's initial temperature was  $34.6^{\circ}\text{C}$ . We also placed a second temperature probe 8 cm into the rectum. Each probe was connected to a separate Blanketrol II hypothermia machine (Cincinnati Subzero) to allow simultaneous monitoring. Two cooling blankets were wrapped around the patient's torso and thighs and connected to the hypothermia machine attached to the oesophageal probe. Cold saline (0.9% sodium chloride) at a temperature of  $4^{\circ}\text{C}$  was infused using a pressure infusion device.

Fig. 1 shows simultaneous measurements of oesophageal and rectal temperatures during induction of hypothermia. Saline boluses and the blanket temperature were determined solely on the basis of the oesophageal probe readings. After the patient left the department, we checked that both machines were properly calibrated: the difference between the machines was less than  $0.1^{\circ}\text{C}$  over a range of temperatures.

The phenomenon of rectal and bladder temperature probe lag<sup>4</sup> is not always taken into account during patient cooling. Many physicians still feel that rectal and/or bladder temperature is the core reference standard. While the rectal and bladder temperatures are usually accurate when the patient is in thermal balance, they may lag behind core temperature during rapid changes in temperature such as occur during rapid induction of hypothermia.<sup>5</sup> Central intravascular monitoring is the most accurate and responsive temperature measurement technique, but is more invasive and associated with complications. The lag time of the oesophageal temperature probe is approximately 5 min.<sup>5</sup> This makes the oesophagus an acceptable site for temperature measurement during the induction phase of therapeutic hypothermia.

In this case, cold saline given through a commercial pressure infuser led to a rapid cooling rate. Our patient's temperature decreased by  $1.6^{\circ}\text{C}$  in 20 min, corresponding to a cooling rate of  $4.8^{\circ}\text{C}/\text{h}$ . This required 1800 ml of iced saline in addition to the

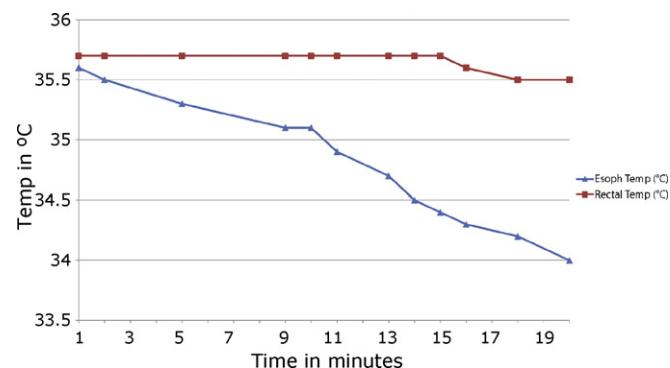


Fig. 1. The patients rectal and esophageal temperatures, recorded simultaneously.

weak effect of the external cooling blankets. This volume of saline and the timing match our previous observations that every 100 ml of pressure-administered fluid will decrease the temperature by approximately  $0.1^{\circ}\text{C}/\text{min}$ .

With such rapid shifts, temperature measurement with a rectal or bladder probe will lag far behind the actual core temperature and potentially lead to overcooling, as continued iced saline is infused unnecessarily. We recommend that an oesophageal probe should be considered as the primary means of temperature monitoring during the induction phase of therapeutic hypothermia.

#### Conflict of interest statement

SDW has no conflicts of interest. SAM is on the scientific advisory board and has received stock options from Radiant Medical; has received a research grant and stock options from Medivance, and is on the scientific advisory board of Seacoast Technologies. KHP has no conflicts of interest.

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